Method and Arrangement for Controlling the Draft Effect of a Flue Duct Upon an Upstream Exhaust Gas Cleaning System

The present invention relates to a method and arrangement for controlling the flue duct draft effect (the chimney draft) upon an upstream exhaust gas cleaning system.

Recently, it is acceptable to operate exhaust gas cleaning systems without reheating the clean gas that leaves the scrubber unit, and to use wet systems as flue ducts. As a result, on the one hand the overall manufacturing costs, and on the other hand the maintenance cost, of the exhaust gas cleaning system can be significantly reduced. For inspection and repair of the components of the exhaust gas cleaning unit, especially in the scrubber, after shutting the boiler down one must take care that the chimney draft in the system components that are to be cleaned or repaired is substantially interrupted or discontinued. This is conventionally accomplished by suitable dampers or other closure elements that are permanently or temporarily installed into the feed and/or discharge lines. Fixedly installed closure elements, such as dampers or the like, form additional resistances in the lines and are themselves susceptible to disruption and vulnerable to repairs. Closure elements that are temporarily installed into the line draft, for

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example balloons that can be inflated from the outside, cannot adequately and reliably absorb the differential pressures and loads that occur in lines having large cross-sections, and/or they require a relatively high installation expenditure.

It is an object of the present invention to reduce the draft effect of the flue duct upon an upstream exhaust gas cleaning system with little expenditure in order to facilitate inspection and repair in the exhaust gas cleaning system.

This object is inventively realized by a method having the features of claim 1 or by an arrangement for reducing the flue duct draft effect (the chimney draft) upon an upstream exhaust gas cleaning system and having the features of claim 10.

Pursuant to the inventive method, one allows a downwardly open flue duct (1; 1') to extend into a vat in such a way that, with the aid of a liquid (condensate) that collects in the vat, a liquid barrier that closes off a flue gas end of the flue duct relative to the environment is formed. To relieve the upstream exhaust gas cleaning system from the flue duct draft effect (chimney draft), at least a portion of the cross-section

of the flue duct is exposed by lowering the level of the liquid below the edge of the flue duct.

The arrangement for controlling the draft effect of a flue duct upon an upstream exhaust gas cleaning system is inventively characterized in that a downwardly open flue duct (1; 1') can be immersed into a vat; in that by means of a liquid (condensate) collected in the vat, a liquid barrier that closes off a flue gas end of the flue duct relative to the environment is formed; and in that the level of the liquid can be lowered below the edge of the flue duct to thereby expose at least a portion of the cross-section of the flue duct in order to relieve the upstream exhaust gas cleaning system from the flue duct draft effect.

By means of the invention, a flue duct or chimney draft through the components of the exhaust gas cleaning system can be reliably avoided during inspection and repair, and the condensate can be reliably withdrawn. The lowering of the level of the liquid or condensate can be realized in a straightforward and rapid manner by removing, e.g. draining, the liquid from the vat until the flue duct is no longer immersed in the liquid. With this procedure, the cross-section of the flue duct, or possibly a partial cross-section, is exposed from below.

Pursuant to a preferred further development of the invention, the level of the liquid is lowered by lowering the vat, together with the liquid, relative to the flue duct, so that the flue duct is no longer immersed in the liquid. In this case, by lowering the vat by an appropriate extent, the lower, open end of the flue duct is exposed to such an extent that the opening is very accessible and, depending upon dimensions, can even be entered by personnel. To restart operation of the exhaust gas cleaning unit, it is necessary only to raise the vat to such an extent that a flue gas closure via the flue duct that is immersed in the liquid of the vat is ensured. Depending upon the distance of the level of the liquid to the lower edge of the flue duct, the flue gas closure can also be accomplished by increasing the liquid level by introducing liquid to beyond the lower edge of the flue duct.

Pursuant to a preferred embodiment of the invention, a trough that is associated with the lower edge of the flue duct, and which outwardly delimits a discharge plate, is used as the vat. This has the advantage that only a small quantity of liquid is necessary in order to ensure a flue gas closure, since the wall of the flue gas duct is surrounded by a relatively small volume of liquid. The discharge plate conveys condensate that occurs or is deposited to the trough.

However, the liquid barrier provides not only for the reliable flue gas closure, but also for the continuous discharge of the condensate that forms. For this purpose, pursuant to a further development of the invention, the liquid is allowed to flow over an outer trough wall in the manner of a weir.

The depth of immersion of the flue duct into the trough can be adjusted and varied by the vertical positioning of the trough.

Pursuant to a further development of the inventive arrangement, the plate that is connected to the liquid trough has a pyramidal, conical or spherical segment shaped configuration and provides for a discharge of the liquid into the liquid-conveying trough, which discharge is distributed over the periphery.

A particular advantage, not only of the inventive method but also of the pertaining arrangement, is that the requirement for a completely open exhaust gas cleaning system is achieved. The exhaust gas cleaning system advantageously requires no components, such as closure dampers, that would significantly contribute to the overall cost of the unit, not only during manufacture but also during maintenance. This open system provides for a reliable interruption of the chimney draft

during inspection, since the flue duct is exposed to such an extent that the chimney draft can be conveyed through the free opening between the vat, or the plate assembly that can be raised and lowered, and the flue duct, and the chimney draft can be reduced at the exhaust gas cleaning unit. With conventional arrangements, it is generally not necessary to supply draft air outside of the lower end of the flue duct. The draft air that is necessary to carry out the inventive method and which is to be supplied to the flue duct from below is, for example, supplied to the flue duct via suitable air supply shutters or louvers that are introduced into components or space about the flue duct, and/or via a sliding door.

The flue duct is freely accessible from below via its plate assembly that can be raised and lowered. Draining of the trough is effected automatically via the liquid barrier, the weir and at least one liquid discharge. Only clear condensate runs over the weir, while solid particles can settle at the bottom of the trough.

Advantageous and/or further developments of the invention are found in the dependent claims.

The invention will now be explained in greater detail with the aid of embodiments schematically illustrated in the drawing, in which:

Fig. 1 shows a schematic illustration of the lower portion of an exhaust gas or flue duct having a clean gas duct connection and a discharge plate assembly that in the illustrated closed position closes off the open lower end of the flue duct in an air tight manner relative to the environment;

Fig. 1A is a schematic cross-sectional view, which is enlarged relative to Fig. 1, of the portion designated "A" in Fig. 1 of a support that can be varied in length and that holds the discharge plate assembly in the closed position according to Fig. 1;

Fib. 1B is a schematic cross-sectional view of the portion of the flue duct designated "B" in Fig. 1 in the closed position of the discharge plate assembly in the region of a liquid barrier having an overflow to a condensate discharge;

Fig. 2 shows a plan view onto the discharge plate assembly, which is in the closed position;

Fig. 2C is an enlarged partial view in conformity with the section "C" in Fig. 2 of the region of the condensate overflow weir;

Fig. 3 shows a schematic illustration of the lower portion of the flue duct in an open position of the discharge plate assembly, supported by lifting mechanisms, whereby the flue duct is exposed toward the bottom and the chimney draft at the flue gas cleaning unit can be reduced by the thereby resulting free plate opening; and

Fig. 4 shows a modified embodiment of the flue duct having a drawn-in lower opening section and an adapted discharge plate assembly that is in the open position similar to Fig. 3.

Fig. 1 schematically illustrates the lower portion of a flue or exhaust gas duct 1 on which is disposed a clean gas duct 2. The flue duct 1 is open at the lower end 3 (Fig. 3) and is closed off from a discharge plate assembly 10 in a gas tight manner in the closed position illustrated in Fig. 1, i.e. in the operating state of the non-illustrated exhaust gas cleaning system that is connected via the clean gas duct 2.

The discharge plate assembly 10 includes a pyramid-shaped discharge plate 11, which is centered on the central axis 5 of the flue duct 1, and also includes a circumferential trough 12 that is connected in a gas tight manner with the discharge plate. In the closed position shown in Fig. 1, the assembly 10 is supported by anchoring means on the flue gas duct 1. In the embodiment being described (Fig. 1A), these anchoring means are formed by connecting or tie rods 14. At the flue duct end, the tie rod 14 is secured to an outwardly projecting bracket 6, and at the bottom it is secured to a supporting or substructure 15 of the assembly 10. By adjusting pertaining tie rod nuts, the vertical position of the assembly 10 can be adjusted relative to the flue duct 1, as will be explained in greater detail subsequently.

In the closed position of the discharge plate assembly 11 illustrated in Fig. 1, the lower end of the flue gas duct 1 extends into the trough 12, which in the operating state is filled with condensate, to such an extentthat a reliable liquid barrier, which closes off the flue gas end of the flue duct 1 relative to the environment, is formed. The depth of insertion is adjusted via the tie rods 14 and can, for example, be 200-300 mm, corresponding to a pressure of ± 20/30 mbar. At this depth of insertion, a so-called blowing through of flue gas when pressure surges occur in the flue duct is adequately and reliably precluded.

Fig. 1B shows a schematic cross-section, which is enlarged relative to Fig. 1, through the trough 12, which is filled with condensate up to thelevel of an overflow dam or weir 17. If further condensate runs out of the flueduct during the operation of the exhaust gas cleaning system into the trough 12, a constant liquid transfer into an overflow 18, which is provided with a condensate discharge, takes place via the overflow weir 17.

In Figure 2C, a plan view onto the overflow weir 17 and the overflow 18 is schematically illustrated. In the embodiment described, overflow weirs are disposed at three locations that are uniformly distributed over the periphery. Tie rods and support means are distributed over the periphery of the discharge plate assembly 10.

In the previously described embodiment of the invention, three supports, which are distributed over the periphery, are provided via tie rods 14 and three overflow weirs 17. It is to be understood that the number of anchoring means and of overflow weirs depends upon the structural prerequisites and can be increased as desired. Instead of the pyramid illustrated in Fig. 2, which has an 8-sided contour, other

pyramids or also rotationally symmetrical discharge plates can also be provided.

In Fig. 3, the discharge plate assembly 10 is shown in the open position relative to the open, lower end 3 of the flue duct 1. This open position corresponds to the inspection state of the exhaust gas cleaning system, which is connected via the clean gas duct. The discharge plate assembly 10 is brought into this open position with the aid of lifting mechanisms 16, which are respectively effective between a bracket 6 and the supporting or substructure 15. By means of these lifting mechanisms, after conclusion of inspection of the exhaust gas cleaning system the discharge plate assembly 10 can again be raised into the closed position illustrated in Fig. 1.

In the open position of Fig. 3, the flue duct is entirely exposed. The chimney draft is conveyed via the exposed opening, and the chimney draft that is present at the exhaust gas cleaning unit is reduced, so that the channel that is open over the exhaust gas cleaning unit remains uninfluenced by the chimney draft.

The lowering and raising of the assembly 10 is effected without difficulty by means of the lifting mechanisms 16 along the central axis 5

of the flue duct 1. In the closed position, the tie rods 14 are suitably anchored for the stationary fixation of the discharge plate assembly, whereby the desired depth of penetration 20 of the flue duct into the condensate of the trough 12 can be precisely adjusted.

The embodiment of Figure 4 differs from that of Fig. 3 in that the lower, open end 19 of the flue duct 1', which is to be closed by the discharge plate assembly 10', is tapered or narrowed by means of a drawn-in portion 21, so that only a partial cross-section of the flue duct is exposed in the open position shown in Fig. 4. In conformity therewith, the discharge plate assembly 10' can be smaller, and can hence be constructed in a more economical manner. In other respects, the embodiment of the arrangement of Fig. 4 corresponds to that of the arrangement of Fig. 3.

A number of modifications are possible within the scope of the inventive concept. Several modifications with respect to the configuration of the discharge plate 11 and the distribution of the overflow weirs 17 and the supports 14, 16 were already described above. The drainage of the trough 12 generally takes place exclusively via the overflow weirs and the condensate discharge. There is notdanger of clogging due to solid particles since the latter settle out at

the base of the trough. However, it is also possible to dispose one or more discharges in the bottom of the trough that can be opened if necessary. The overflow weirs could be designed so as to be adjustable in height in order to be able to vary the depth of penetration of the exhaust gas duct within certain limits independently of the vertical position of the discharge plate assembly.